

A study on Global features based techniques LDA, PCA and LBP Algorithm for face recognition and Attendance system

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Abstract: In modern life image processing system have a great role in our life. Everywhere we need to recognize and verify the person using face, eye, finger print etc. In this paper we review the basic method and technique about face recognition system. Face recognition become very much popular now a day to recognize person with their face, to avoid crime etc. this mechanism is based on the division of the face processing in three phase i.e. face detection, feature extraction based on the input face image and face recognition. In this paper, we are considering three algorithms such as Principal Component analysis (PCA), Linear Discriminant Analysis (LDA) and Local Binary Patterns (LBP). The comparison of the rate of accuracy of face recognition is also compared. The advantages and disadvantages of these algorithms will help in obtaining a solution, so that a better face recognition system can be designed.

Index Terms - DCT, LBP, PCA, LDA, Face Recognition

I. INTRODUCTION

Facial characteristics are very important in the recognition of the Face. Compared to different biometrics, which include fingerprint, DNA, or voice, face popularity is more natural, nonintrusive and can be used without the cooperation of the difficulty. Due to powerful computers technologies and the advancement in the field of pattern recognition, real time based face recognition systems becomes very much popular and also achieve satisfying performance under controlled conditions, that leads to various applications. A face recognition system can be used in two modes: verification (or authentication) and identification. A face verification device entails the identification of character via verifying their photo one to 1. On the opposite hand, a face identification system tries to set up the identity of a given person out of a pool of N human beings (one-to-N matching). When the identity of the man or woman might not be within the database that is referred to as open set identification. While verification and identity often share the equal category algorithms, each modes target wonderful packages. In verification mode, the primary programs situation get right of entry to control, together with computer or cellular device log-in, building gate control, digital multimedia data access. Over conventional security get entry to systems, face verification has many advantages: the biometric signature cannot be stolen, misplaced or transmitted, like for ID card, token, badges or forgotten like passwords or PIN codes. In identification mode, potential programs specially contain video surveillance (public locations, restricted regions), records retrieval (police databases, multimedia statistics control) or human computer interplay (video games, private settings identity). An automatic face verification gadget consists of two main face detection and face verification. The purpose of the face detection module is to determine whether or not there are any faces in a photograph (or video sequence), and if so, to go back their function and scale. The term face localization is employed at the same time as there's one and handiest one face in the photo. When the localization step handiest gives a hard segmentation of the face vicinity, a put up-processing face alignment step can be required. This step entails locating facial talents, which include eyes, nose, mouth or chin, on the way to geometrically normalize the face place. Face detection is an crucial place of studies in computer vision, as it serves, as a necessary first step, any face processing device, along with face recognition, face tracking or expression analysis. Faces are non-rigid, dynamic objects with a large diversity in shape, color and texture, due to multiple factors such as head pose, lighting conditions (contrast, shadows), facial expressions, occlusions (glasses) and other facial features (make-up, beard). Large variability in face appearance also affects face verification. Same face shows different variations between the images because of the illumination and viewing direction are always more than the image variation due to change in face identity. Another difficulty comes from the lack of reference images to train face templates. The few available training data are usually not enough to cover the intra-personal variability of the face. Moreover a significant mismatch between training and testing conditions may happen (especially lighting). Finally, the verification performance is highly related to the quality of the face localization step.

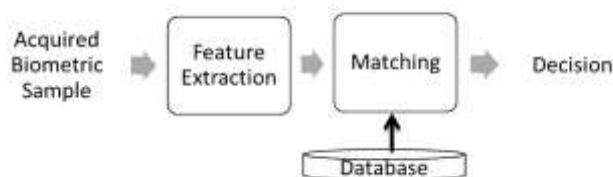


Figure 1: Flow chart of typical biometric system

II. AIM OF THE PAPER

We try to develop a compact software using Matlab, Which helps to record the attendance of people. We recognize the each people face with the store database and track their attendance. This paper having the different algorithm. We use LDA, PCA and LBP Algorithm for face recognition, This is fast and efficient the previous algorithm. We also try to implement in the attendance system.

III. OBJECTIVE

The main objective of this paper is to compare the performance of all the algorithms. Although face detection receives considerable attention, it still remains a difficult pattern recognition task, because of the high variability of the face appearance. .

A. Principal Component analysis (PCA) algorithm:

PCA for face recognition is based at [4] the statistics concept method. It extracted the relevant statistics in a face image and encoded successfully as viable. It identifies the subspace of the image space spanned by way of the training face image facts and de-correlates the pixel values. The classical instance of a face image is [1] obtained via projecting it to the coordinate machine defined with the useful resource of the vital additives. The projection of face snap shots into the principal trouble subspace achieves information compression, de-correlation and dimensionality reduction to facilitate desire making. In mathematical terms, the main components of the distribution of faces or the eigenvectors of the covariance matrix of the set of face photographs, is sought by way of treating an image as a [8][9]. We practice PCA on this database and get the unique feature vectors the use of the following method. Suppose there are P patterns and every pattern has training images of $m \times n$ configuration. PCA also known as Karhunen- Loeve [2] method is one of the popular methods for feature selection and dimension reduction. Recognition of human faces using PCA was first done by Turk and Pentland [29] and reconstruction of human faces was done by Kirby and Sirovich [30]. The recognition method, known as eigen face technique [3] defines a function area which reduces the dimensionality of the unique facts space. This decreased records space is used for popularity. But poor discriminating power in the class and huge computation are the widely known not unusual troubles in PCA approach.

- The database is rearranged within the form of a matrix in which every column represents an image.
- With the help of Eigen values [1] and Eigen vectors covariance matrix is computed.
- Feature vector for each picture is then computed.
- This function vector represents the signature of the photograph. Signature matrix for entire database is then computed.
- Euclidian distance of the picture is computed with all of the signatures inside the database.
- Image is recognized as the only which offers least distance with the signature of the photograph to recognize.

Advantages

- It absolutely de-correlates any facts within the remodel domain.
- It packs the maximum energy in the fewest wide variety of transform coefficient.
- It minimizes the MSE (mean square mistakes) between the reconstructed and unique facts for any specified statistics compression.
- It minimizes the total entropy of the information.

Disadvantages

- There isn't rapid set of rules for its implementation.
- The PCA is no longer a constant rework but has to be generated for each kind of facts statistics
- There is full-size computational attempt are wished for generation of Eigen values and Eigen values of the covariance matrix.

B. Linear Discriminant Analysis (LDA) algorithm:

LDA algorithm can easily discriminate between the data. LDA maximizes the between-elegance scatter and minimizes the within-class scatters. This criterion tries to maximize the ratio of the determinant of the among-class scatter matrix of the projected samples to [5] the determinant of the inside-class scatter matrix of the projected samples. To understand an image, the photograph is projected and the projected take a look at picture is compared to every projected training photograph, and the take a look at photo is identified due to the fact the nearest training image. The interior magnificence scatter matrix represents how face images are dispensed carefully internal training and among class scatter matrix describes how commands are separated from each other. Whilst face images are projected into the discriminant vectors, face pictures need to be allotted carefully within classes and need to be vector in a very excessive dimensional face space [7] separated among lessons, as much as possible. By reducing the denominator using discriminant vector, the numerator gets increased. The use of Linear Discriminant Analysis for statistics category is implemented to type problem in speech recognition. We determined to put in force an algorithm for LDA in hopes of offering higher type compared to Principle Components Analysis [13]. Linear Discriminant Analysis (LDA) Find a sub-area which maximizes the ratio of inters class and intra-elegance variability. Same intra-elegance variability for all lessons can best classify a face which is "recognized" to the database. LDA is also carefully associated with main component analysis (PCA) in as those each algorithms are based totally on linear alterations and try to classify the records in a given picture. LDA is essentially famous for the classification of statistics into inside magnificence and among instructions. It attempts to maximize the between elegance scatter to within magnificence scatter. It is a statistical approach for classifying samples of unknown commands based totally on training samples with mentioned commands. This method tries to maximize between-magnificence (i.e. throughout customers) variance and decrease inside-class variance. Based on the class information, LDA algorithm recognizes the face. This method tries to categorize the samples which lie between classes. This will try to discover the best class for the sample which lies in between the training and attempt to maximize the ration of between class variance to within magnificence variance. The essential purpose of this method is to get the nice separation between the lessons. This method tries to maximize the general variance of all instructions in dataset to inside class variance. This technique makes use of best one optimizing criterion to convert the statistics sets and hence all information factors regardless of their magnificence identity are converted the usage of this transform. In this type of LDA, every magnificence is considered as a separate magnificence against all other classes.

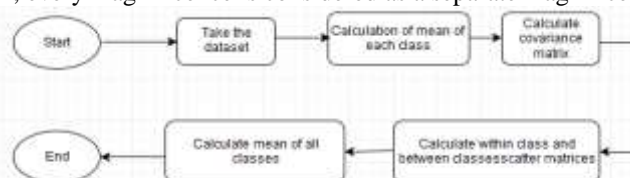


Figure 2: Block Diagram of LDA algorithm

The objective of LDA is to perform dimensionality reduction while preserving as much of the class discriminatory information as possible.

$$Y=W^T X$$

The method selects WLDA in such a way that the ratio of the between- class scatter (SB) and the within-class scatter (Sw) is maximized.

$$S_w = \sum_{i=1}^c \sum_{x_i \in X_i} (x_i - \mu_i)(x_i - \mu_i)^T$$

$$S_B = \sum_{i=1}^c N_i (\mu_i - \mu)(\mu_i - \mu)^T$$

Where, N_i = Number of samples in class X_i

μ = Overall mean

μ_i = Mean image of class X_i

$$S_B W = \lambda S_w W$$

The method selects WLDA in such a way that the ratio of the between class scatter (SB) and the within-class scatter (SW) is maximized.

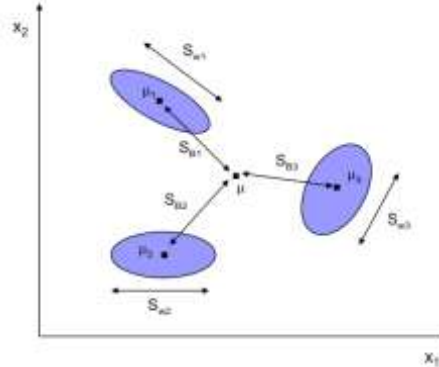


Figure 3: Spatial representation of LDA algorithm

C. Local Binary Patterns (LBP) algorithm

The face detection set of rules delivered in this phase is an extension of Viola and Jones algorithm [15] primarily based on boosted cascades of Haar-like functions. As pointed out by way of Zhang et al. [16], those features are very efficient inside the cascade to quickly discard maximum of the history areas. However, in the last stages of the cascade, a large number of Haar-like features (several hundred) are necessary to reach the desired detection/false acceptance rate trade-off. It results in a long training procedure and cascades with several dozens of stages which are difficult to design. Furthermore, Haar-like features are not robust to local illumination changes. To cope with the limitation of Haar-like features, we propose to use LBP features. The method to build the weak classifiers is inspired by the work of Froba and Ernst [19] and the cascade training is done with AdaBoost [18].

LBP Features

The LBP operator is a non-parametric 3x3 kernel which summarizes the nearby spacial shape of an image. It turned into first added by means of Ojala et al.[26] who confirmed the high discriminative power of this operator for texture classification. At a given pixel role (xc, yc), LBP is described as an ordered set of binary comparisons of pixel intensities among the center pixel and its eight surrounding pixels. Ojala et al. [17] prolonged their original LBP operator to a circular community of different radius size. Note that every little bit of the LBP code has the identical significance level and that successive bit values may have a totally special which means. Actually, The LBP code can be interpreted as a kernel structure index. By definition, the LBP operator is unaffected by using any monotonic grey-scale transformation which preserves the pixel depth order in a nearby neighborhood. Later, Ojala et al. [17] extended their authentic LBP operator to a circular community of different radius length. Their LBP P, R notation refers to P similarly spaced pixels on a circle of radius. Recently, new versions of LBP have regarded. For example, Jin et al. [20] remarked that LBP features leave out the neighborhood structure under some positive situation, and for this reason they delivered the Improved Local Binary Pattern (ILBP). Huang et al. [28] pointed out that LBP can handiest reflect the first derivation statistics of pics, but couldn't gift the rate of local version. To remedy this hassle, they proposed an extended model of Local Binary Patterns (ELBP). Due to its texture discriminative assets and its very low computational cost, LBP is turning into very famous in sample reputation. Recently, LBP has been applied for instance to stand detection [20], face recognition [21, 22], photograph retrieval [24], motion detection [25], visible inspection [23]. We subsequently factor out that, approximately in the equal time the authentic LBP operator become brought via Ojala [26], Zabih and Woodfill [27] proposed a completely similar local structure feature. This function, referred to as Census Transform, also maps the local neighborhood surrounding a pixel. With recognize to LBP, the Census Transform most effective differs by means of the order of the bit string. Later, the Census Transform has been extended to grow to be the Modified Census Transform (MCT) [19] which takes into account the center pixel inside the bit string and compares to the average intensity values in the community. The neighborhood binary pattern (LBP) approach could be very effective to describe the image texture features. LBP has advantages along with excessive-pace computation and rotation invariance, which facilitates the wide utilization inside the fields of photograph retrieval, texture exam, face reputation, picture segmentation, etc. Recently, LBP [11] turned into efficaciously implemented to the detection of shifting gadgets thru background subtraction. In LBP, each pixel is assigned a texture cost, which can be certainly blended with goal for monitoring thermo photograph and monochromatic video. The main uniform LBP styles are used to understand the key points inside the target region after which form a mask for joint coloration-texture feature selection [31]. LBP is defined as an ordered set of binary comparisons of pixel intensities among the centre pixel and its eight surrounding pixels. The decimal cost of the resulting eight-bit phrase (LBP code) ends in 28 feasible aggregate that is known as Local Binary Patterns.

Basic LBP operator

The LBP operator is based on the binary and grayscale images, in the field of texture description which has many advantage over other methods designed earlier. This is done by thresholding every pixels of the image by assigning a label. This figure 4 shows the use of the 3x3 neighborhood.



Figure 4: Basic LBP operator [20]

Steps involve in LBP Algorithm

- 1) In this LBP histogram method, labeling is done to each pixel of an image with the LBP code.
- 2) This LBP code image is divided into several blocks.
- 3) LBP Histogram for each block of an image is calculated and the histogram calculated for each blocks is combined together so that actual image can be obtained.

Advantages:

- Effective to explain photograph texture Feature.
- Used in Texture analysis, Image Retrievals, face recognition and Image segmentation.
- Detection of moving item thru Background Subtraction.
- It is a Simple Approach.
- Computationally easy than Haar like function and rapid.
- The most critical properties of LBP capabilities are tolerance in opposition to the monotonic illumination modifications and computational simplicity.

Disadvantages:

- LBP method is insensitive towards small change occurred in the Face Localization.
- Use of large region in this method increases the errors.
- It is not sufficient for the non-monotonic illumination changes.
- Not accurate.
- This method is only used for binary and gray images.

Summary:

From the study of all the three algorithm of face detection it becomes clear that the LBP algorithm is much better than the LDA and PCA algorithm. Because the tolerance to monotonic gray-scale changes and the computational efficiency of the LBP operator is also better [6] since it does not need gray-scale normalization before applying the LBP operator to the face image. When no error or small error present in LBP. This error will increase when large region is selected for face recognition. The use of large region obtained better recognition rate. The automatic attendance system is also proposed with this system so that this system can become more powerful. The primary reason for this betterment of the set of rules is its commonplace use in numerous fields with computerized attendance gadget effectively of implementation. LBP has been carried out for instance to stand detection, face reputation, photo retrieval, motion detection, visible inspection, motion detector and so on. These functions are very green early in the cascade to fast discard the history areas. However, inside the ultimate ranges of the cascade, a massive number of Haar-like features (numerous hundred) are essential to attain the desired detection/false recognition fee change-off. Furthermore, [10] Haar-like functions aren't sturdy to nearby illumination changes. To address the hindrance of Haar-like functions, we endorse to apply LBP features to be able to produce the optimized outcomes as we require. There are such a lot of faces which the any regular man or women seen in his daily life, but out of which they take into account few of them. The faces which they keep in mind are based on some feature based totally method they no longer precisely recognize the precise face however they recognize the function of the particular face of the character. There are some unique feature [12][16] via which a exact man or woman are recognize, like his color of eyes, form of the ear which can be continue to be identical his all existence. There are a few features which might be modifications because the age is boom like form of nostril, form of the lips and so forth. Face Recognition is very complex technique that find the exact suit or minimal threshold price face to discover due to the fact the face photo which might be coming for popularity might also incorporate noise or may be the light inside the face or the color inside the face photograph isn't right. The face which are coming for popularity cause comprise many beneficial records but using these kind of statistics may be very plenty time ingesting and eat lots of price, so we reduce the some facts like in this way by using which the useful information are not discarded. For this we are the use of PCA that is the reduction approach which reduces the parameter of the images. PCA makes use of Eigen faces [29] and Euclidean distance for matching the perfect face from the database. We use LBP techniques rather than the LDA and PCA algorithm for face recognition, LBP is pretty better than the alternative algorithms. The Face Recognition are used in lots of places like Air ports, Military bases, Government workplaces, also use for each day attendance cause in the multinational groups. Face Recognition has two phases first phase is the training of the faces which the faces are stored inside the database and 2nd face is the verification phase wherein they should locate the precise in shape of the face that are present inside the database.

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V. DISCUSSION

In this paper, we work for face recognition based attendance system. This is helpful for count and recognize number of person in any seminar and conference hall. This application can be used in educational institutions, company administrators for regular maintain the attendance records of employee, students and admin. We already survey the different attendance system, the previous system works manually needs to touch or be key-press system. This project have easy installation process with low cost.

VI. CONCLUSION

LBP algorithm is much better than other two methods of the face recognition. This algorithm uses Haar-Like features for the instance of the face detection, face recognition, image retrieval, motion detection, visual inspection, motion detector etc. comparatively LDA and PCA is having limited scope of recognition of face or motion. The extended version of this algorithm is based on the texture discriminative property and its very low computational cost, LBP is becoming very popular in these types of the recognition.

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